



# Types of Forces

Notes

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- A force is a **push** or **pull** acting upon an object as a result of its interaction with another object. There are a variety of types of forces; we have already talked about contact vs. field forces. The following forces (which are explained in more detail below) are categorized as either contact or field forces.

# Contact vs. Field Forces

<u>Contact Forces</u>	<u>Action-at-a-Distance Forces (Field Forces)</u>
Frictional Force	Gravitational Force
Tension Force	Electrical Force
Normal Force	Magnetic Force
Air Resistance Force	
Applied Force	
Spring Force	

# Applied Force

$F_{\text{app}}$

- **A force that is applied to an object by a person or another object.**
- If a person is pushing a desk across the room, then there is an applied force acting upon the object. The applied force is the force exerted on the desk by the person.

# Gravity Force (aka: Weight)

$F_{\text{grav}}$

- **The force with which the earth, moon, or other massively large object attracts another object towards itself. By definition, this is the weight of the object.**
- All objects upon earth experience a force of gravity that is directed "downward" towards the center of the earth.

# Normal Force

$F_{\text{norm}}$

- **The support force exerted upon an object that is in contact with another stable object; perpendicular to surface ALWAYS!**
- For example, if a book is resting upon a surface, then the surface is exerting an upward force upon the book in order to support the weight of the book. On occasions, a normal force is exerted horizontally between two objects that are in contact with each other. For instance, if a person leans against a wall, the wall pushes horizontally on the person.

# Friction Force

$F_{\text{frict}}$

- **The force exerted by a surface as an object moves across it or makes an effort to move across it.**
- Though it is not always the case, the friction force often opposes the motion of an object. For example, if a book slides across the surface of a desk, then the desk exerts a friction force in the opposite direction of its motion. Friction depends upon the nature of the two surfaces and upon the degree to which they are pressed together.

# Air Resistance Force

$F_{\text{air}}$

- **A special type of frictional force that acts upon objects as they travel through the air.**
- The force of air resistance is often observed to oppose the motion of an object. This force will frequently be neglected due to its negligible magnitude. It is most noticeable for objects that travel at high speeds (e.g., a skydiver or a downhill skier) or for objects with large surface areas.



# Tension Force

$F_{\text{tens}}$

- **The force that is transmitted through a string, rope, cable or wire when it is pulled tight by forces acting from opposite ends.**
- The tension force is directed along the length of the wire and pulls equally on the objects on the opposite ends of the wire.

# Spring Force

$F_{\text{spring}}$

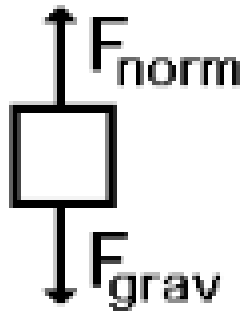
- **The force exerted by a compressed or stretched spring upon any object that is attached to it.**
- An object that compresses or stretches a spring is always acted upon by a force that restores the object to its rest or equilibrium position.

# Practice

- A book is at rest on a tabletop. Diagram the forces acting on the book.

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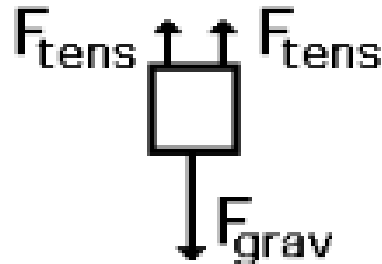


## Practice

- A girl is suspended motionless from the ceiling by two ropes. Diagram the forces acting on the combination of girl and bar.

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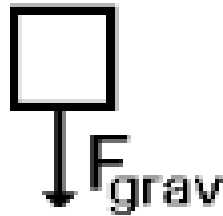


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- An egg is free-falling from a nest in a tree. Neglect air resistance. Diagram the forces acting on the egg as it is falling.

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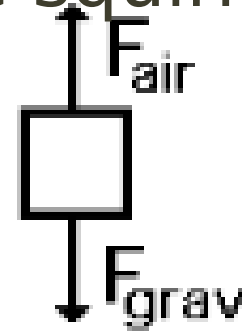


# Practice

- A flying squirrel is gliding (no *wing flaps*) from a tree to the ground at constant velocity. Consider air resistance. Diagram the forces acting on the squirrel.

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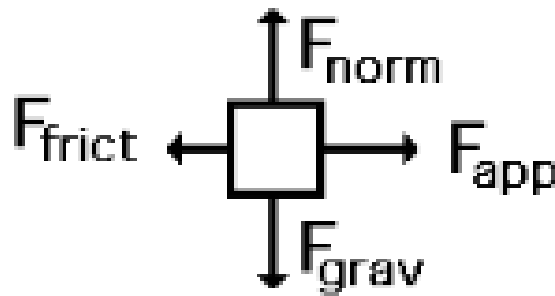


# Practice

- A rightward force is applied to a book in order to move it across a desk with a rightward acceleration. Consider frictional forces. Neglect air resistance. Diagram the forces acting on the book.

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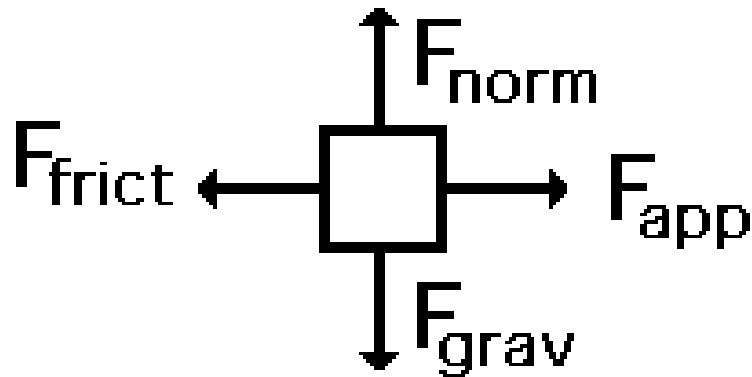


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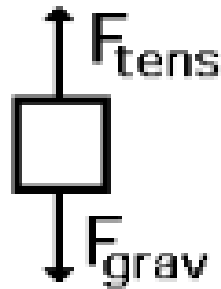


# Practice

- A college student rests a backpack upon his shoulder. The pack is suspended motionless by one strap from one shoulder. Diagram the vertical forces acting on the backpack.

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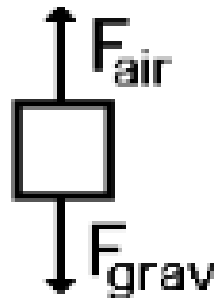


# Practice

- A skydiver is descending with a constant velocity. Consider air resistance. Diagram the forces acting upon the skydiver.

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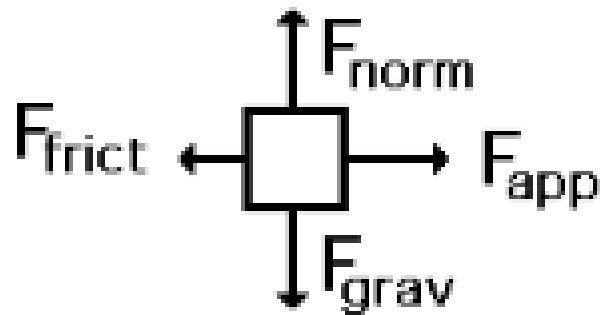


# Practice

- A force is applied to the right to drag a sled across loosely packed snow with a rightward acceleration. Diagram the forces acting upon the sled.

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# Practice

- A football is moving upwards towards its peak after having been *booted* by the punter. Diagram the forces acting upon the football as it rises upward towards its peak.

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